



United States
Environmental Protection
Agency

Air and Radiation
(6202)

EPA 430-F-96-060
October 1996

APPLICATION PROFILE

Planned Maintenance: Industrial Lighting Systems



GRAINGER®

Zone Distribution Center
Atlanta, Georgia

Project Manager:
Al Tierney

Contractor:
Illumetek Corporation

PROJECT RESULTS

Installed Cost	\$26,000
Annual Energy Cost Savings	\$10,400 (9%)
Annual Maintenance Cost Savings	\$1,200 (10%)
Internal Rate of Return	44%
Annual kWh Savings	130,000 kWh
Pollution Prevention	
CO ₂	195,000 lbs/yr
SO ₂	1,980 lbs/yr
NO _x	716 lbs/yr

TYPICAL APPLICATIONS

- Warehouses
- Manufacturing
- Processing
- Assembly
- Inspection



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For help in starting a
planned maintenance
program, contact a Green
Lights Lighting
Management Company
Ally. For a list of these
companies, call the Green
Lights Hotline at
1-888-STAR-YES.

PLANNED MAINTENANCE: INDUSTRIAL LIGHTING SYSTEMS

Reducing Maintenance Expenses and Improving Efficiency

In industrial environments, safety and productivity are critical to success. When an individual lamp burns out, the lighting quality suffers until the lamp is replaced. And the costs associated with lamp replacement and the possible disruption of operations can be exorbitant. Through a program of planned lighting maintenance, relamping labor costs can be minimized while improving lighting quality.

There are three factors that contribute to reduced light levels from industrial lighting systems, and all three factors can be controlled with a planned maintenance program:

Dirt Depreciation. As dirt accumulates on the lamps and fixtures, less light is delivered to the working area, possibly affecting worker productivity and safety.

Lamp Lumen Depreciation. As lamps age, less light is produced (even though your energy cost remains constant). This effect may be particularly noticeable with mercury vapor, metal halide, and VHO-fluorescent lamps.

Lamp Burn-Outs. If lamps are not immediately replaced upon burn-out, light levels may be insufficient in some areas.

By cleaning all of the fixtures and replacing the lamps at planned intervals, dirt accumulation is reduced, lamps are replaced before they reach their least-efficient level, and lamp burn-outs are minimized.

Benefits

- Savings in labor costs for lamp replacement and fixture cleaning
- Improved workplace appearance with fewer burnouts
- Fewer "emergency" relamping calls; fewer disruptions

- Higher fixture efficiency with cleaner fixtures
- Savings in lamp material, storage and disposal costs due to fewer, but larger lamp purchases

Issues

- Where group relamping and cleaning strategies make the most sense.
 - *high-ceiling areas*, where it is more expensive to access the fixtures
 - *dirty environments*, where the effects of dirt accumulation are more significant
 - *systems with regular operating hours*, where it is easy to schedule a group maintenance interval and minimize the nuisance of frequent spot failures
 - *metal halide systems*, where group replacement reduces the effects of lamp lumen depreciation, color shift, and non-passive lamp failures
- Because group relamping intervals may be in the range of 2-4 years, annual relamping budgets can be leveled by servicing an equal portion of the facility's light fixtures each year.
- Lighting systems should be group-relamped at intervals of 70 percent of the lamps' *calendar life*, which is calculated as $0.70 \times \text{estimated lamp life (hrs)}/\text{annual operating hours (hrs/yr)}$.
- Maintain a written policy that describes the schedule and procedures used for your group maintenance program. Include a cost justification in the policy for future reference.

CASE STUDY

GRAINGER[®]

Grainger's has discovered how to convert the lighting efficiency gains from group relamping and cleaning into energy cost savings, while cutting maintenance costs. Besides saving money, their lighting upgrade and maintenance program also improved lighting quality by producing uniform illumination with reduced color shift.

The 250,000-SF Atlanta Zone Distribution Center stores Grainger's products for distribution in their southeast markets. Before the upgrade, the lighting had been provided by 594 standard, universal-position 400-watt metal halide lamps, yielding an average of 25 footcandles maintained on the stock. Grainger's Real Estate Project Manager, Al Tierney, was interested in saving energy in this facility while maintaining the existing light levels and color rendering.

The upgrade was simple and cost-effective. Using their lighting management contractor, Illumetek Corporation, each of the 400-watt metal halide

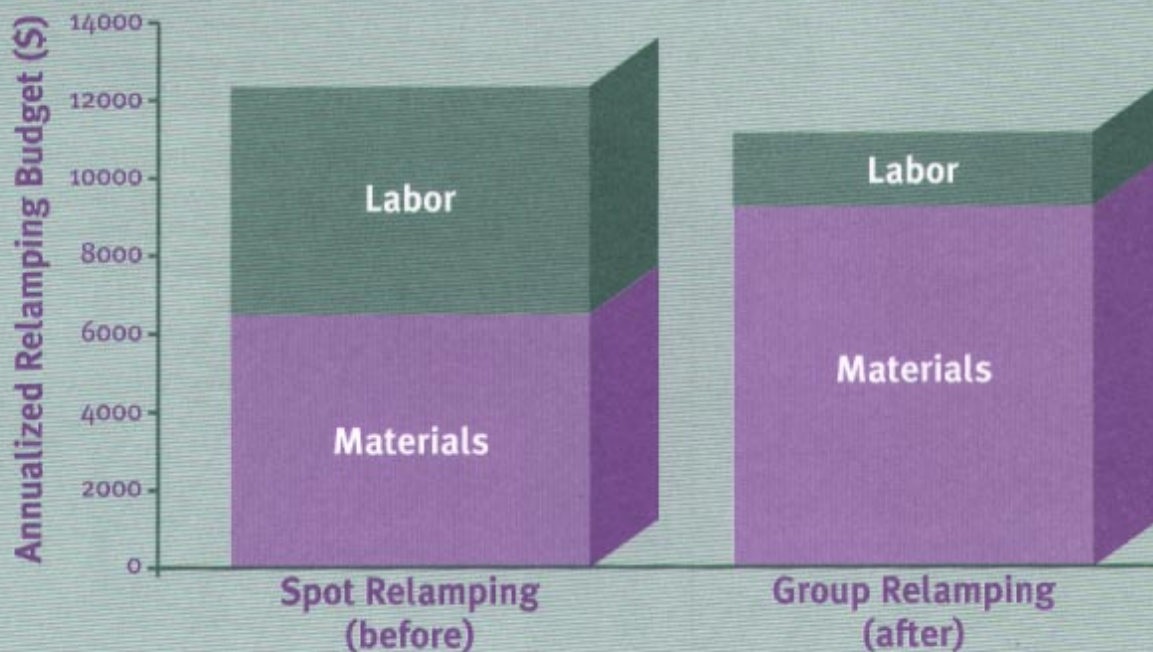
lamps were directly replaced with vertical-position, 360-watt metal halide lamps. Although these energy-saving lamps save 40 watts per fixture, they produce a 6 percent reduction in maintained light output. However, luminaire cleaning offset this reduction, increasing light levels (initially) to 37 footcandles.

Joe expects this initial light level to gradually decline due to dirt accumulation and lamp lumen depreciation. To reduce this light loss and maintain or improve the pre-upgrade light levels, Al plans to have the lighting system group-relamped and cleaned every 2.5 years (at approximately 70 percent of the lamps' 20,000-hour rated life). Over this maintenance cycle, the illumination will be maintained at an average of 30 footcandles, achieving Al's illumination goal. The savings in combined energy and maintenance costs amount to approximately \$11,600 per year.



// This group relamping approach enables us to minimize our lighting costs for both operation and maintenance. //

*- Al Tierney
Real Estate Project Manager*



WILL IT WORK FOR YOU?

Use the following graphs to estimate the cost-effectiveness of a planned maintenance program in your facility.

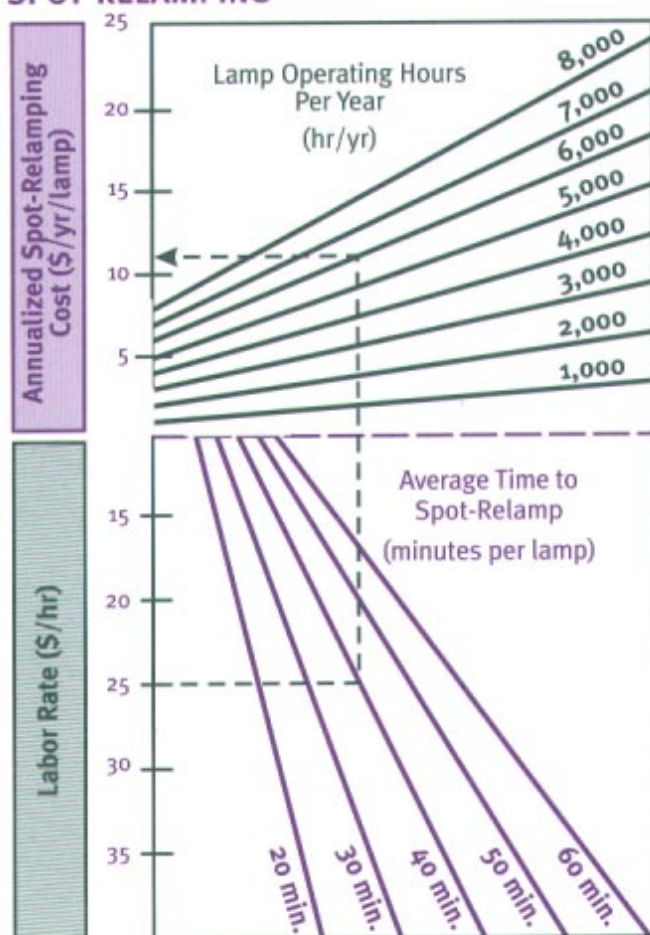
- Determine your lighting maintenance labor rate (per individual) in dollars per hour. *In the example shown below, the labor rate is \$25 per hour.*
- Draw a horizontal line from this point until it intersects the line that represents the average total number of minutes of labor time to replace one lamp (including cleaning) on a spot basis (as lamps fail). *In our example, we estimate that the average spot relamping time is 40 minutes, which includes set-up and clean-up.*
- Draw a vertical line from this point until it intersects the curve that represents your estimate of annual lighting operation hours. *In our example, the lighting system operates 6,000 hours per year.*
- Draw a horizontal line from this point until it intersects the vertical axis that measures the annualized budget for spot relamping on a per-lamp basis. *In our example, the spot relamping budget is approximately \$11 per lamp.*
- Multiply the total number of lamps under consideration in your facility by the per-lamp budget determined in the above step. This is your estimated maintenance cost for spot relamping.
- Repeat this procedure on the right graph using a reduced relamping time to determine the maintenance budget amount associated with a group maintenance program.

The Green Lights Program offers 2-day Lighting Upgrade Workshops, Application Profile brochures, and other technical support services to assist program participants in applying cost-saving lighting strategies. For more information, call the Green Lights Hotline at 1-888-STAR-YES.

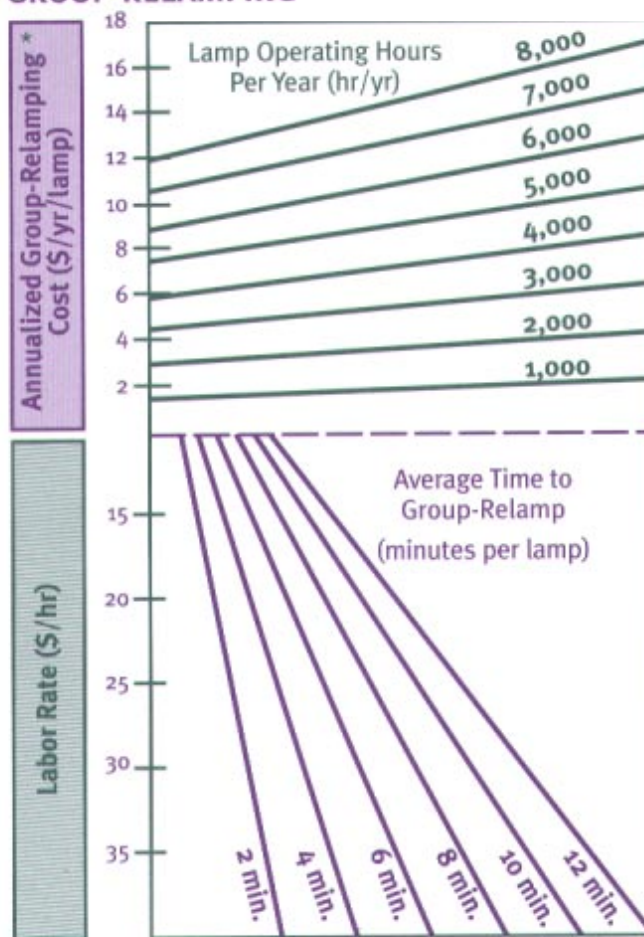
Graph Assumptions

- HID lamp material cost of \$17.00 each
- 20,000-hour lamp life
- Lamp disposal cost of \$3.00 per lamp
- Group relamping at 70 percent rated life

SPOT RELAMPING



GROUP RELAMPING



* Group relamping cost includes 5% spot replacement @ 30 minutes/lamp due to premature lamp failures.